Animal, Plant & Soil Science

D2-4
Conservation Tillage Practices

Interest Approach

- Ask students what challenges the first farmers faced as colonists moved across North America. Some of the challenges involved clearing land and preparing the soil for planting. Focus on soil preparation and ask students how farmers turned the soil. Are the practices they used still widespread today? Why or why not?

Objectives

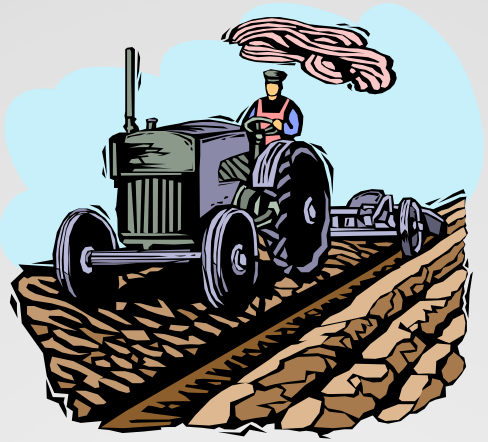
- 1 Explain why tillage is used in crop production.
- 2 Describe conventional tillage.
- 3 Describe conservation tillage and explain how it can reduce erosion.
- 4 Discuss the relationship between agriculture and the environment and explain how conservation practices protect the environment.

Terms

- conservation tillage
- continuous cropping
- conventional tillage
- crop rotation
- double cropping
- organic farming
- post-emergence tillage
- pre-plant tillage
- primary tillage
- secondary tillage
- sustainable agriculture
- tillage

Why is tillage used in crop production?

- I. ***Tillage*** is working the soil to provide a favorable environment for seed placement, germination, and crop growth.



Why is tillage used in crop production?

- A. To grow properly, seeds need a moist soil at the appropriate temperature with sufficient air for seed respiration. The seedbed should be loose enough for good aeration, yet compact enough around the seed for good soil-seed contact. It should be free of clods that prevent proper seedling emergence.

Why is tillage used in crop production?

- B. There are a variety of tillage system options available to the crop producer. However, there are three basic goals that must be met by whatever tillage system a producer decides to utilize. Those three goals are:

Why is tillage used in crop production?

- 1. Weed control—The importance of tillage for weed control has declined with the increase in herbicide use. Some herbicides are incorporated into the soil by shallow tillage. Tillage for weed control can be divided into two time periods.
  - a. ***Pre-plant tillage*** is tillage of the soil before the crop is planted. This tillage prepares a weed-free seedbed that reduces the weed pressure during the growing season. This tillage is designed to destroy young weed seedlings.
  - b. ***Postemergence tillage*** is tillage done between rows of growing crops. This cultivation is designed to destroy or bury emerging weed seedlings. Deep cultivation or cultivation late in the growing season could sever crop roots.

Why is tillage used in crop production?

- 2. Physical soil conditions—Tillage alters physical soil properties such as structure, moisture, and temperature. Tillage during seedbed preparation stirs and loosens soil, improves aeration, and creates a suitable medium for plant growth. Deep tillage and subsoiling may temporarily break up subsoil compaction.

Why is tillage used in crop production?

- 3. Crop residue management—After a crop is harvested, residues like stalks or leaves remain in the field. The amount of residue depends on the type of crop, how well it grew, and how it is harvested. Different tillage methods leave varying amounts of crop residue on the surface of the soil.

What is conventional tillage?

- II. ***Conventional tillage*** is a tillage system made up of two stages: primary tillage and secondary tillage. ***Primary tillage*** breaks up the soil and buries crop residues. This is often accomplished with a soil-inverting implement, such as a plow. ***Secondary tillage*** produces a fine seedbed by a series of operations that break up the soil into smaller and smaller chunks.

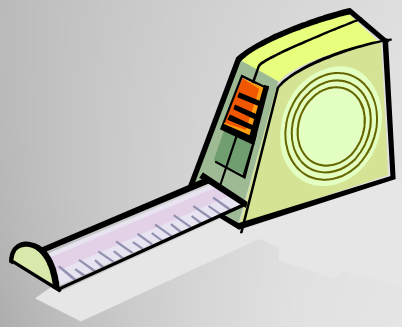
What is conventional tillage?

- A. The traditional primary plowing tool is the moldboard plow.

- 1. The moldboard plow shears off a section of soil, tips it upside down, and fractures it along several planes. During this process, any organic matter on the soil surface is buried. When finished, this implement leaves the soil surface very rough, with a series of ridges and furrows.

What is conventional tillage?

- 2. Other primary tillage tools are the disc plow and subsoilers. A disc plow is an implement with a series of 3 to 10 large (2–2.5 feet) discs mounted on a frame at an angle to the direction of travel.

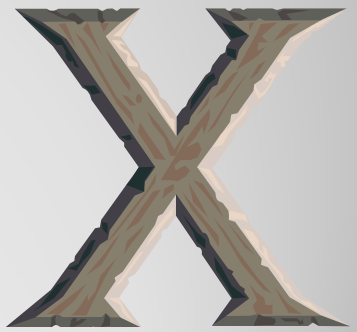


What is conventional tillage?

- B. Secondary tillage is usually a two-step process.
- 1. First, ridges left from plowing are smoothed out, and large clods are broken. Then, smaller lumps are pulverized, and a fine seedbed is produced.

What is conventional tillage?

- 2. The first step is commonly accomplished with a tandem disc. The typical tandem disc has four gangs of discs set like the four arms of an “X.” The front two gangs turn the soil inward, and the back two turn it back out.



What is conventional tillage?

- 3. A spring-tooth harrow can also be used in secondary tillage. This implement is made of long, springy, C-shaped teeth with a shear point or broad shovel that digs into the soil, dragging clods to the surface and breaking them up. A finishing harrow or drag is used to pulverize the soil clods into a smooth, fine surface.

What is conservation tillage and how can it reduce erosion?

- III. ***Conservation tillage*** is a tillage program aimed at reducing erosion by leaving crop residues on a rough soil surface. Rather than plowing under crop residues, some or all of the residue is left exposed. The definition of conservation tillage requires that, at planting, 30 percent or more of the soil surface be covered with crop residues. Conservation tillage reduces water and wind erosion by at least 40 to 50 percent. This practice also improves organic matter content near the surface of the soil.

What is conservation tillage and how can it reduce erosion?

- A. As with all things, conservation tillage has its advantages and disadvantages when compared to conventional tillage.

- 1. Soil prepared by conservation tillage tends to be cooler than clean-tilled soil because of light reflection off the mulch and increased soil moisture. In warm climates, cooler soil benefits production but may hinder initial plant growth in northern states.

What is conservation tillage and how can it reduce erosion?

- 2. Conservation tillage provides the benefit of fewer trips across the field. This means less time spent in the field and lower fuel costs. This can also translate into reduced soil compaction because of less wheel traffic.

- 3. With less tillage in a conservation tillage program, greater reliance is placed on herbicides for weed control. Tillage will kill any weed seedling, but herbicides are more selective. This makes weed identification and herbicide selection critical.

What is conservation tillage and how can it reduce erosion?

- B. Because of soil conservation and the economic benefits of conservation tillage, its use has spread rapidly. The term conservation tillage covers several different tillage methods. Some of them are:

What is conservation tillage and how can it reduce erosion?

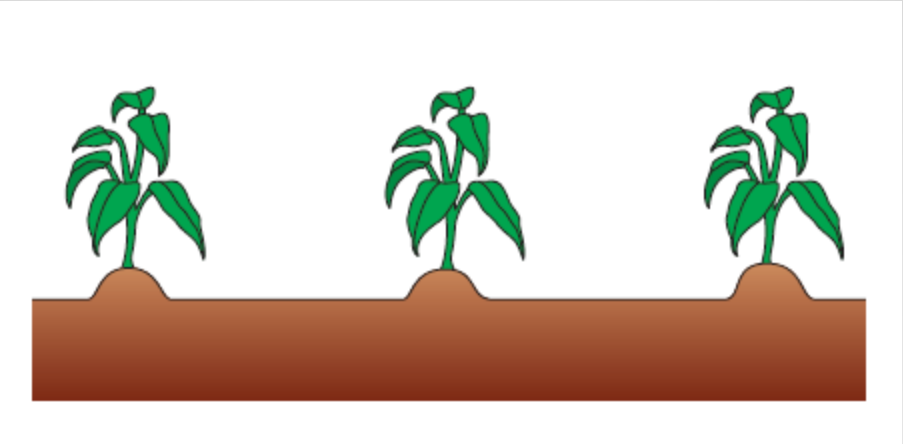
- 1. Mulch-till or chisel-plow—A chisel plow loosens the soil but does not invert it. This is used for primary tillage. Chisel plowing to 8 inches leaves the soil rough with about 50 to 80 percent residue cover. Light disking can then reduce residues to 30 to 50 percent. Seeds are then planted through the remaining residues.

What is conservation tillage and how can it reduce erosion?

- 2. Strip-till—With no primary tillage, a specialized implement tills a band of soil and plants seeds into the band. Another implement sweeps residues off a strip into the middle of the rows. This operation normally leaves about 50 percent of crop residue.

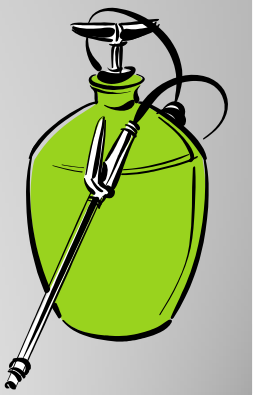
What is conservation tillage and how can it reduce erosion?

- 3. Ridge-till—The ridge-till system excels in cool, moist conditions. Seed is planted on 6-inch ridges with crop residues swept into the shallow furrows. About two-thirds of crop residues remain after planting. Cultivation with special tools minimizes residue burial and rebuilds ridges for the coming year.



What is conservation tillage and how can it reduce erosion?

- 4. No-till—In this method, the soil is barely disturbed. Specialized planters cut a slot through the residue, insert the seed and possibly fertilizer, and then close the slot. About 90 percent of the soil surface remains untouched after planting. Herbicides are the main form of weed control used in this system.



What is the relationship between agriculture and the environment and how do conservation practices protect the environment?

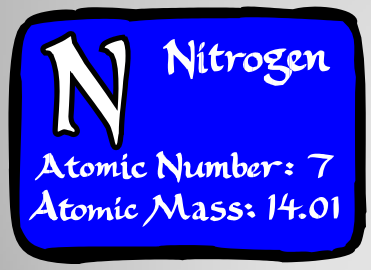
- IV. A number of different cropping systems are available to the crop producer. The system selected depends on climate, economics and market demand, government programs, and producer preferences. Each system requires different soil management techniques and has different effects on the soil. Some of the most common cropping systems are:

What is the relationship between agriculture and the environment and how do conservation practices protect the environment?

- A. Continuous cropping—In ***continuous cropping***, a producer grows the same crop each year. Many favor this system because it allows the producer to grow the most profitable crop. It also allows a person to specialize in the crop best suited to local soil or climate. However, yields often decline with continuous cropping.

What is the relationship between agriculture and the environment and how do conservation practices protect the environment?

- B. Crop rotation—***Crop rotation*** means that a series of different crops is planted on the same piece of land in a repeating order. Crop rotation has important benefits. Crop rotation aids the control of diseases and insects that rely on one plant host. It helps control weeds. Crop rotation supplies nitrogen if certain legumes are in the rotation. It improves soil organic matter and tilth, and it reduces erosion if the rotation includes small grains and forages.



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- C. Double cropping—***Double cropping*** is the practice of harvesting two crops from the same land in one year. A common example is planting soybeans into winter wheat stubble. In this system, soil is covered with vegetation for a larger part of the year, thus reducing erosion. Also, this allows the producer to gain two incomes off the property. However, double cropping does draw more heavily on soil nutrients and water.

What is the relationship between agriculture and the environment and how do conservation practices protect the environment?

- D. Organic farming—***Organic farming*** is farming in which no inorganic fertilizers or synthetic pesticides are used. There are many varieties of organic farms. Organic farms depend on tillage and other cultural techniques to control pests.

What is the relationship between agriculture and the environment and how do conservation practices protect the environment?

- E. Sustainable agriculture—Increasing concern for long-term farm productivity and the effect of agricultural practices on the environment led to this concept. ***Sustainable agriculture*** is a philosophy and collection of practices that seek to protect resources while ensuring adequate productivity. It strives to minimize off-farm inputs, such as fertilizer and pesticides, and to maximize on-farm resources, such as livestock manure and nitrogen fixation by legumes. Soil and water management are central components.

REVIEW

- 1. Why is tillage used in crop production?
- 2. What is conservation tillage and how can it reduce erosion?
- 3. What is conservation tillage and how can it reduce erosion?
- 4. What is the relationship between agriculture and the environment and how do conservation practices protect the environment?